WHAT IS CLAIMED:

1. A gundrill for forming deep holes in a body of material as the gundrill is rotated, axially advanced and supplied with drilling fluid, the gundrill comprising:

an elongate tubular shank having a driven end, a distal end and a tubular central region extending axially therebetween, the tubular shank having a non-circular fluted cross-section extending from the distal end for at least a substantial portion of the length of the central region providing an elongate flow path between the hole being drilled and the periphery of the tubular shank for drilling fluid, which is pumped into an internal passage formed through the tubular shank's central region to exit the hole being drilled and remove chips; and

a cutting member affixed to the distal end of the tubular shank, the cutting member having an internal fluid passageway which is coupled to the tubular shank internal passage and terminates in an orifice formed in a tip end surface, and a flute extending axially from the tip end surface toward and generally aligned with the fluted cross-section of the tubular shank, the flute defined in part by a secondary flank surface and a generally radially extending primary rake surface having a peripheral rake edge lying on a cylindrical surface coaxial with the central axis, and a generally radially extending cutting edge at the tip end which defines a radially offset point;

wherein the tip end surface of the cutting member cooperates with the hole being drilled to define a bottom space area therebetween which receives drilling fluid through the tip orifice and discharges drilling fluid through the outlet passage which is generally bounded by the distal edge of the secondary flank surface and the bottom of

the hole being drilled, wherein the drilling fluid flows through the outlet passage into the elongate fluid return path initially forming a maximum angle β, relative to the hole axis when viewed radially, which is greater than sixty-six degrees in order to effectively cool the tip cutting edge with minimal drilling fluid stagnation.

2. The gundrill of claim 1 wherein the minimum cross-sectional area of the outlet passage is less than a longitudinal cross sectional area of the bottom space taken along the hole axis.

3. The gundrill of claim 1 wherein the minimum cross-sectional area of the outlet passage is less than seventy-five percent of a longitudinal cross sectional area of the bottom space taken along the hole axis.

4. The gundrill of claim 1 wherein the minimum cross-sectional area of the outlet passage is less than fifty percent of a longitudinal cross sectional area of the bottom space taken along the hole axis.

5. The gundrill of claim 1 wherein the minimum cross-sectional area of the outlet passage is less than twenty-five percent of a longitudinal cross sectional area of the bottom space taken along the hole axis.

6. The gundrill of claim 1 wherein the minimum area of the outlet passage is sufficiently small so that drilling fluid exit angle β is greater than seventy-five degrees.

7. The gundrill of claim 1 wherein the minimum area of the outlet passage is sufficiently small so that drilling fluid exit angle β is greater than eighty degrees.

8. A gundrill for forming deep holes in a body of material as the gundrill is rotated, axially advanced and supplied with drilling fluid, the gundrill comprising:

an elongate tubular shank having a driven end, a distal end and a tubular central region extending axially therebetween, the tubular shank having a non-circular fluted cross-section extending from the distal end for at least a substantial portion of the length of the central region providing an elongate flow path between the hole being drilled and the periphery of the tubular shank for drilling fluid which is pumped into an internal passage formed through the tubular shank's central region to exit the hole being drill and remove chips; and

a cutting member affixed to the distal end of the tubular shank, the cutting member having an internal fluid passageway which is coupled to the tubular shank internal passage and terminates in an orifice formed in a tip end surface, and a flute extending axially from the tip end surface toward and generally aligned with the fluted cross-section of the tubular shank, the flute defined in part by a secondary flank surface and a generally radially extending primary rake surface having a peripheral rake edge lying on a cylinder coaxial with the central axis, and a generally radially extending cutting edge at the tip end which defines a radially offset point;

wherein the tip end surface of the cutting member cooperates with the hole being drilled to define a bottom space area therebetween which receives drilling fluid through the tip orifice and discharges drilling fluid

through an outlet passage, which is generally bounded by the distal edge of the secondary flank surface and the bottom of the hole being drilled, the outlet passage having a minimum cross-sectional area which is less than a longitudinal cross-sectional area of the bottom space area taken along the hole axis.

9. The gundrill of claim 8 wherein the cross-sectional area of the outlet passage is less than seventy-five percent of a longitudinal cross sectional area of the bottom space.

10. The gundrill of claim 8 wherein the cross-sectional area of the outlet passage is less than fifty percent of a longitudinal cross sectional area of the bottom space.

11. The gundrill of claim 8 wherein the cross-sectional area of the outlet passage is less than twenty-five percent of a longitudinal cross sectional area of the bottom space taken along the axis and through the orifice.

12. The gundrill of claim 8 wherein the drilling fluid flows through the outlet passage into the elongate fluid return path initially forming an angle β, relative to the hole axis when viewed radially, which is greater than seventy degrees in order to effectively cool the tip cutting edge with minimal drilling fluid stagnation.

13. The gundrill of claim 8 wherein the drilling fluid flows through the outlet passage into the elongate fluid return path initially forming a maximum angle β, relative to the hole axis when viewed radially, which is

greater than seventy-five degrees in order to effectively cool the tip cutting edge with minimal drilling fluid stagnation.

14. The gundrill of claim 8 wherein the drilling fluid flows through the outlet passage into the elongate fluid return path initially forming a maximum angle β, relative to the axis of the hole being drilled when viewed radially, which is greater than eighty degrees in order to effectively cool the tip cutting edge with minimal drilling fluid stagnation.

15. A method of forming a deep hole in a workpiece using a gundrill, the method comprising:

forming a gundrill having an elongate tubular shank having a driven end, a distal end and a central region extending therebetween along a central axis, the tubular shank having a cross-section defining a shank flute extending from the distal end for at least a substantial portion of the length of the central region providing a portion of an elongate fluid return path between the hole being drilled and the shank flute allowing drilling fluid which is pumped into an internal fluid passage formed through the tubular shank to exit the hole being drilled removing chips as they are formed, and a cutting tip affixed to the distal end of the tubular shank, the cutting tip having an internal fluid passageway which is coupled to the tubular shank internal passage and terminates in an orifice formed in a tip end surface, and a tip flute extending axially from the tip end surface toward and aligned with the shank flute providing a portion of the elongate fluid return path, the tip flute defined by a secondary flank surface and a generally radial extending primary rake surface having a

peripheral rake edge lying on a cylindrical surface coaxial with the central axis and a generally radially extending cutting edge at the tip end which defines a radially offset point; and

supplying the gundrill with drilling fluid while simultaneously rotating and axially advancing the gundrill into the workpiece at the desired hole location wherein the tip end surface of the cutting tip cooperates with the hole being drilled to define a toroidal bottom space area having a portion thereof, which lies between the end of the tip and hole bottom forming a pressurized end clearance volume, which receives drilling fluid through the tip orifice and discharges drilling fluid through an outlet passage, which is generally bounded by the distal edge of the secondary flank surface and the bottom of the hole being drilled;

wherein the minimum cross-sectional area of the outlet passage is less than a longitudinal cross sectional area of the bottom space taken along the hole axis, so that the flow of drilling fluid discharged from the outlet passageway has sufficient velocity to remove chips as they are formed at the hole bottom and carry the chips out of the hole as the drilling fluid exits through the elongate fluid return path.

16. The method of claim 15 wherein the minimum cross-sectional area of the outlet passage is less than seventy percent of a longitudinal cross sectional area of the bottom space.

17. The method of claim 15 wherein the minimum cross-sectional area of the outlet passage is less than fifty percent of a longitudinal cross sectional area of the bottom space.

18. The method of claim 15 wherein the minimum cross-sectional area of the outlet passage is less than thirty percent of a longitudinal cross sectional area of the bottom space.

19. A method of forming a deep hole in a workpiece using a gundrill, the method comprising:

forming a gundrill having an elongate tubular shank having a driven end, a distal end and a central region extending therebetween along a central axis, the tubular shank having cross-section defining a shank flute extending from the distal end for at least a substantial portion of the length of the central region providing a portion of an elongate fluid return path between the hole being drilled and the shank flute allowing drilling fluid, which is pumped into an internal fluid passage formed through the tubular shank, to exit the hole being drilled removing chips as they are formed, and a cutting tip affixed to the distal end of the tubular shank, the cutting tip having an internal fluid passageway, which is coupled to the tubular shank internal passage and terminates in an orifice formed in a tip end surface, and a tip flute extending axially from the tip end surface toward and aligned with the shank flute providing a portion of the elongate fluid return path, the tip flute defined by a secondary flank surface and a generally radial extending primary rake surface having a peripheral rake edge lying on cylindrical surface coaxial with the central axis, and a generally radially extending cutting edge at the tip end which defines a radially offset point; and

supplying the gundrill with drilling fluid while simultaneously rotating and axially advancing the gundrill into the workpiece at the desired hole location wherein the

tip end surface of the cutting tip cooperates with the hole being drilled to define a toroidal bottom space area having the portion thereof which lies between the end of the tip and hole bottom forming a pressurized end clearance volume, which receives drilling fluid through the tip orifice and discharges drilling fluid through an outlet passage, which is generally bounded by the distal edge of the secondary flank surface and the bottom of the hole being drilled;

wherein the drilling fluid flows through the outlet passage into the elongate fluid return path initially forming a maximum angle β, relative to the hole axis when viewed radially, which is greater than sixty-six degrees in order to effectively cool the tip cutting edge with minimal drilling fluid stagnation and remove chips as they are formed at the hole bottom and carry the chips out of the hole as the drilling fluid exists through the elongate fluid return path.

20. The method of claim 19 wherein angle β is greater than seventy degrees.

21. The method of claim 19 wherein angle β is greater than seventy-five degrees.

22. The method of claim 19 wherein angle β is greater than eighty degrees.

23. The method of claim 19 wherein the minimum cross-sectional area of the outlet passage is less than a longitudinal cross sectional area of the bottom space taken along the hole axis, so that the flow of drilling fluid discharged from the outlet passageway has sufficient velocity to remove chips as they are formed at the hole

bottom and carry the chips out of the hole as the drilling fluid exits through the elongate fluid return path.

24. The method of claim 23 wherein the minimum cross-sectional area of the outlet passage is less than seventy percent of a longitudinal cross sectional area of the bottom space.

25. The method of claim 23 wherein the minimum cross-sectional area of the outlet passage is less than fifty percent of a longitudinal cross sectional area of the bottom space.

26. The method of claim 23 wherein the minimum cross-sectional area of the outlet passage is less than twenty-five percent of a longitudinal cross sectional area of the bottom space.